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Research Article

FUNCTIONAL CHEVON ROLLS FORTIFIED WITH CINNAMON BARK AND ALOE-VERA POWDER EXTRACTS

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ABSTRACT

Functional chevon rolls were developed by incorporating *aloe vera* powder (0.40%) and cinnamon bark (0.25%) phyto-extracts separately, after replacing lean meat in the pre-standardized formulation. Proximate composition of cooked rolls noticed a non-significant (P>0.05) decrease in protein and fat content in the treated products as compared to control. The incorporation of *aloe vera* and cinnamon bark extracts at increasing level resulted in decreasing the scores of all sensory attributes of developed products. However the overall acceptability of chevonrolls with 0.40% *aloe vera* extract (T_1) was rated above 7.0 and chevonrolls with 0.25% cinnamon extract (T_2) was comparable to Control. Thus good quality chevon rolls was developed by incorporating *aloe vera* extract at 0.40% and cinnamon extract at 0.25%.

Key words: *Aloe vera*, Cinnamon, Phyto-extracts, Sensory attribute

Quality deterioration of food induced by oxidative damage is regarded as main culprit of food spoilage along with microbial changes. To counter it, use of natural antioxidants in place of synthetic oxidants is widely preferred by meat industry due to associated harmful effects on consumer's health by consuming the latter. The antioxidant effect of various phyto-ingredients in meat system had been widely documented in several published studies such as oat quackers in chicken cutlets (Singh *et al.*, 2014 a; b), broccoli and carrot powder in chicken cutlets (Singh *et al.*, 2015 a; b; c), aloe vera and cinnamon bark extracts as potential natural antioxidants (Rathour *et al.*, 2017 a; b), watermelon rind extract in pork patties (Kumar *et al.*, 2018) etc.

Aloe vera is well known for its medicinal properties owing to more than 200 different bioactive substances having antimicrobial and antioxidant activity (α-tocopherol, carotenoids, ascorbic acid, flavonoids and tannins). *Cinnamomum zeylanicum* contains cinnamaldehyde, eugenol, cinnamic acid, cinnamyl acetate etc. (Vangalapati *et al.*, 2012), which posses antioxidant, antimicrobial and medicinal properties. Addition of bark or powder directly into meat products could severely affect organoleptic quality. Moreover, they will be required in a higher concentration to exert their antimicrobial and antioxidant effect. Thus, incorporation of their extracts can be a promising approach. Thus, present study was undertaken to develop functional chevon rolls by incorporating optimum levels of *aloe vera* and cinnamon extracts.

MATERIALS AND METHODS

Goat meat samples were obtained after slaughtering as per standard procedure in the experimental slaughterhouse of Department of Livestock Products Technology, College of Veterinary Science, GADVASU, Ludhiana, Punjab, India. The dressed carcasses were brought to the laboratory and hot deboned manually. After removal of all separable tissues, boneless meat was packed in colourless low density polyethylene (LDPE) bags and stored over night at 4±1°C in refrigerator for conditioning and then frozen at -18±1°C for subsequent use. The spice ingredients were procured from local market and after removal of extraneous matters the spices were oven dried at 50±2°C for 2 h (Table 1). The ingredients were ground mechanically and sieved through a fine (U.S.S. #30) mesh screen. The 90% ethanolic extract of *Aloe vera* and cinnamon bark used in study were prepared at time, temperature combination of 15 min for 65°C and 9h for 60°C respectively (Rathour *et al.*, 2017a).

The frozen deboned meat was thawed overnight at

Table 1
Composition of spice mix

Name of ingredients	Percentage (w/w)
Aniseed (*Soanf*)	10.0
Black pepper (*Kalimirch*)	10.0
Capsicum (*Mirch* powder)	6.0
Caraway seeds (*Ajwain*)	10.0
Cardamom dry (*Badi Elaichi*)	5.0
Cardamom dry (*Chhoti Elaichi*)	2.0
Cinnamon (*Dalchini*)	5.0
Cloves (*Laung*)	5.0
Coriander (*Dhania*)	17.0
Cumin seeds (*Zeera*)	15.0
Dry ginger powder (*Soanth*)	8.0
Mace (*Javitri*)	5.0
Nutmeg (*Jaifal*)	2.0
Total	100

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refrigeration temperature (4±2° C) and cut into small chunks of uniform size and run twice through meat mincer (MADO ESKIMO MEW 714, Spain) and further divided into three groups i.e., without added phyto-extracts (Control) and with *aloe vera* extract (Ta_1-0.2%, Ta_2-0.4% and Ta_3-0.6%) and cinnamon extract (Tc_1-0.25 %, Tc_2-0.50% and Tc_3-0.75%) by replacing lean meat. The other ingredients were 70% chevon, 9% chilled water, 10% vegetable oil, 3.80% condiments (onion, ginger and garlic in a ratio of 3:1:1), 1.60% salt, 3.50% refined wheat flour, 1.50% dry spices, 0.30% sodium tetrapolyphosphates, 0.30% sugar and 100 ppm nitrite. All the ingredients were mixed in bowl chopper (Scharfen TC 11, Witten, Germany) to produce emulsion following standard protocols. The emulsion was filled in stainless steel cylindrical moulds and cooked at 120ºC for 30 minutes till the internal temperature of patties reached to 75±2°C recorded at geometric centre of the patties using probe thermometer. The roll obtained was put for various physico-chemical, instrumental texture, colour profile and sensory evaluation attributes. Based on sensory evaluation, chevon emulsion with 0.40% *Aloe vera* (T_1) and 0.25% cinnamon extracts (T_2) were selected and used for further quality evaluation.

Analytical procedures: The pH of emulsion and chevon roll was determined by using digital pH meter (FE-20-1-KIT, Mettler-Toledo India Pvt. Ltd., Mumbai) equipped with a combined glass electrode. Emulsion stability of chevon emulsion was measured by as per Townsend *et al.* (1968) with some modifications. Cooking yield was determined by measuring the difference in sample weight before and after cooking. The moisture, protein, fat, and ash content of chevon rolls were estimated using automatic moisture analyzer, Kel plus, Socs Plus, and Muffle furnace, respectively following the method of AOAC (1995). Texture profile analysis (TPA) was conducted using Texture Analyzer (TMS-PRO, Food Technology Corporation, USA). Colour profile was measured using LovibondTintometer (Model: RT-300) set at 2º of cool white light (D) and known as '*L**', *a**, and *b** values. '*L**' value denotes brightness (100) or lightness (0), *a** (+redness/- greenness), *b** (+yellowness/-blueness) values. The hue and chroma (saturation) values were calculated using the formula, (tan- 1 (b/a)) and $(a^2+b^2)^{½}$, respectively.

Sensory evaluation: A seven member experienced panel comprising scientists and postgraduate students of the Department evaluated samples for the attributes viz. appearance and colour, flavour, texture, juiciness and overall acceptability using 8-point descriptive scale, where 8 = extremely desirable and 1=extremely undesirable. Three sittings (n=21) were conducted for each replicate.

Statistical analysis: Data was analyzed statistically on 'SPSS-16.0' software package as per standard methods (Snedecor and Cochran, 1994). The data were subjected to statistical analysis by analysis of variance (CRD-ANOVA) and Duncan's multiple range test. Each experiment was replicated thrice and the samples were analyzed in duplicate leading to total observation whereas, for texture and colour profile n=9 (triplicate reading) and sensory attributes n = 21 (7 members).

RESULTS AND DISCUSSION

Chevon rolls incorporated with *Aloe vera* extract: The results for physico-chemical properties and sensory evaluation of chevon rolls incorporated with the three different levels of *aloe vera* extract are presented in Table 2. The pH of chevon emulsion decreased significantly ($P<0.05$) and a decreasing trend was observed with the increasing incorporation level of *Aloe vera* extract (AVE) in the formulation. This could be attributed to the incorporation of AVE having lower pH (4.0-6.5). Boudreau and Beland (2006) reported that low pH in *Aloe vera* enriched products might be attributed to the range of compounds including polysaccharides, phenolic compounds, enzymes, vitamins and organic acids present in the aloe pulp. Emulsion stability of Ta_3 was significantly lower ($P<0.05$) than control whereas the emulsion stability of Ta_1 and Ta_2 was comparable to control and Ta_3. This decrease in emulsion stability might be due to decrease in pH which resulted in decrease in water holding capacity of the treatment products.

The incorporation of AVE in chevon rolls resulted in decreasing the scores of all the sensory parameters viz. appearance, flavour, texture, juiciness and overall acceptability. The value for appearance score of all the treatment products was significantly lower ($P<0.05$) than control which might be due to lighter colour of AVE not liked by the panellists in the chevon rolls. The flavour scores of Ta_2 and Ta_3 were significantly lower ($P<0.05$) than control but the score for the Ta_1 was comparable to control. The texture and juiciness scores of Ta_2 and Ta_3 were significantly lower ($P<0.05$) than control but the score for the Ta_1 was comparable to control and other treatment products. Significant decrease ($P<0.05$) in juiciness scores of treatment products might be due to the decrease in pH and loss of moisture during cooking. The overall acceptability scores for all the treatment products was significantly lower ($P<0.05$) than control which is the reflective of scores of other sensory parameters. But, overall acceptability scores for the Ta_1 and Ta_2 was

Table 2

Physico-chemical, sensory and instrumental colour analysis of chevon emulsion incorporated with selected *Aloe vera* extract

Parameters	Control (C)	*Aloe vera* Extract levels		
		Ta_1(0.2%)	Ta_2(0.4%)	Ta_3(0.6%)
Emulsion pH	6.46±0.02^{b}	6.40±0.02^{ab}	6.45±0.02^{b}	6.38±0.01^{a}
Emulsion Stability	87.97±0.52^{b}	85.16±1.15^{a}	85.94±0.32^{ab}	86.87±0.94^{ab}
Sensory Analysis				
Appearance	7.33±0.05^{b}	7.12±0.06^{a}	7.05±0.05^{a}	7.02±0.09^{a}
Flavour	7.34±0.07^{b}	7.16±0.05^{b}	7.00±0.06^{a}	6.85±0.07^{a}
Texture	7.17±0.05^{b}	7.00±0.07^{ab}	6.91±0.07^{a}	6.83±0.08^{a}
Juiciness	7.25±0.10^{c}	7.17±0.10^{bc}	6.93±0.07^{b}	6.61±0.08^{a}
Overall Acceptability	7.57±0.06^{b}	7.20±0.05^{a}	7.15±0.10^{a}	6.97±0.07^{a}
Instrumental Colour Profile				
Redness(a* value)	9.36±0.18^{c}	8.84±0.25^{bc}	8.62±0.17^{b}	8.16±0.19^{a}
Yellowness(b* value)	8.10±0.03	8.07±0.21	8.42±0.15	7.89±0.30
Lightness	40.74±0.19^{a}	41.38±0.27^{ab}	43.68±0.80^{b}	42.34±0.76^{ab}
Hue	12.39±0.12^{b}	11.98±0.16^{b}	12.05±0.16^{b}	11.36±0.30^{a}
Chroma	153.47 ±2.09^{b}	143.64±4.02^{b}	145.74±4.02^{b}	129.56±6.97^{a}

*Mean±S.E with different superscripts row wise (small alphabet) differ significantly (P<0.05).n =6 for each treatment. (C-chevon rolls without extract)

recorded higher than very good (7.0) sensory rating. Incorporation of AVE significantly (P<0.05) affected the redness value (*a**) and lightness (*L**) of chevon rolls whereas the decreasing trend was noticed in redness value and increasing trend was noticed in lightness (*L**) of chevon rolls. While the yellowness (*b**) increased non-significantly (P>0.05) upon increasing level of incorporation of AVE in treated products. This decrease in redness value and increase in lightness value could be attributed to the lighter colour of AVE.

On the basis of physico-chemical, sensory and instrumental colour analysis, chevon rolls incorporated with 0.4% *Aloe vera* extract by replacing the lean meat in the standardized formulation was found to be most suitable for the development of chevon rolls.

Chevon rolls incorporated with cinnamon bark extract: The results for physico-chemical properties and sensory evaluation of chevon rolls incorporated cinnamon bark extract (CBE) are presented in table 3. The pH of chevon emulsion was significantly (P<0.05) higher than the control treatment and increasing trend was noticed in pH values of treatment products with increasing incorporation level of cinnamon bark extract (CBE) in the formulation. This could be attributed to the incorporation of CBE having higher pH. Emulsion stability of Tc_2 and Tc_3 was significantly lower (P<0.05) than control whereas the emulsion stability of Tc_1 was comparable to control. Decrease in emulsion stability with incorporation of CBE was recorded. This might be due to loss of moisture during cooking. Incorporation of CBE significantly reduced redness value (*a**). The yellowness (*b**) and lightness (*L**) values of chevon rolls were comparable among all the treatments and control. Hue angle and chroma, were also affected significantly with increase in the level of CBE. The hue and chroma values for all the treated products were significantly lower (P<0.05) than control whereas the values were comparable among the treatments, since both were calculated values and depended on the respective values of *a** and *b**.

The incorporation of CBE at increasing levels resulted in decreasing the scores of all the sensory attributes viz. appearance, flavour, texture, juiciness and overall acceptability for chevon rolls. The value for appearance score of Tc_2 and Tc_3 were significantly lower (P<0.05) than control but the score for the Tc_1 was comparable to control. The flavour scores of Tc_3 was significantly lower (P<0.05) than control and other treatment products, but the score for the Tc_1 was comparable to control. The texture scores for all the treatment products were significantly lower (P<0.05)than control but the score for the Tc_1 was higher than very good sensory rating. The juiciness scores of Tc_3 was significantly lower (P<0.05) than control and other treatment products, but the score for the Tc_1 was comparable to control. Significant decline (P<0.05) in juiciness scores of treatment products might be due to the higher loss of moisture during cooking. The overall acceptability scores for Tc_2 and Tc_3 were significantly lower (P<0.05) than control but the scores for the Tc_1 was comparable to control which is the reflective of scores of

Table 3
Physico-chemical, sensory, and instrumental colour analysis of chevon emulsion incorporated with selected cinnamon bark extract

Parameters	Control (C)	Cinnamon bark extract levels		
		Tc_1 (0.25%)	Tc_2 (0.50%)	Tc_3 (0.75%)
Emulsion pH	6.39±0.04[b]	6.49±0.02	6.51±0.02[a]	6.52±0.01[a]
Emulsion Stability	89.58±1.48	86.58±1.35	87.54±1.33	84.48±1.82
Sensory Analysis				
Appearance	7.42±0.05[b]	7.31± 0.05[b]	6.77±0.08[a]	6.55±0.19[a]
Flavour	7.11±0.78[c]	7.20±0.06[c]	6.07±0.08[b]	5.74±0.09[a]
Texture	7.43±0.05[d]	7.19±0.01[c]	6.71±0.01[b]	6.43±0.07[a]
Juiciness	7.24±0.14[c]	7.04±0.07[c]	6.67±0.08[b]	6.38±0.08[a]
Overall Acceptability	7.41±0.04[c]	7.35±0.05[c]	6.81±0.12[b]	6.38±0.08[a]
Instrumental Colour Profile				
Redness (a* value)	8.55±0.09[a]	8.39±0.07[a]	8.50±0.16[a]	9.36±0.06[b]
Yellowness (b* value)	8.45±0.10	8.44±0.13	8.30±0.04	8.49±0.12
Lightness	42.41±0.33	43.55±0.38	44.35±1.2	44.00±0.62
Hue	12.02±0.08[a]	11.90±0.11[a]	11.88±0.12[a]	12.64±0.13[b]
Chroma	144.56±2.01[a]	141.70±2.70[a]	141.33±2.97[a]	160.83±3.35[b]

*Mean±S.E with different superscripts row wise (small alphabet) differ significantly (P<0.05).n =6 for each treatment. (C-chevon rolls without extract).

other sensory parameters.

On the basis of physico-chemical, sensory and instrumental colour analysis, chevonrolls incorporated with 0.25% cinnamon bark extract by replacing the lean meat in the standardized formulation was found to be most suitable for the development of chevon rolls.

Quality evaluation of Chevonrolls: The control (C) and treatment product with selected level of aloe vera extract (T_1) and Cinnamon bark extract (T_2) was evaluated for its physicochemical properties and sensory evaluation (Table 4).

The pH value of treatments and control were recorded comparable, however, pH of $T_1$was recorded the lowest value. Soltanizadeh and Ghiasi-Esfahani (2015) also reported decrease in pH values of beef burger on incorporation of *Aloe vera* at 5% level. Cooking yield of both the treatment products was slightly lower than control product which is reflective in the emulsion stability of the respective treatments. Proximate composition analysis of cooked rolls noticed a non-significant (P>0.05) decrease in protein and fat content in the treated products as compared to control, this could be due to replacement of chevon with phyto-extracts containing comparatively lesser protein and fat content than chevon. The both treatment products (T_1 and T_2) had significantly higher (P<0.05) ash content than control product which might be due to higher ash content inphyto-extracts. The *a**value for T_2 was significantly higher (P<0.05) than control and T_1 whereas the *a** values were comparable among the control and T_1. Increase in the redness value of cooked products could be due to non-enzymatic browning reaction (Maillard reaction) between sugars (CHO group) and amino (NH_2) group of meat protein during cooking. Similar findings have been reported by (Verma *et al.*, 2015) in pork patties and (Kantale *et al.*, 2019) in restructured spent hen meat slices. The lightness (*L**) value of T_1 was significantly higher (P<0.05) than control. Higher *L**value for T_1 might be due to lighter colour of *Aloe vera* extract of chevon emulsion.

The incorporation of phyto-extracts at optimum level significantly affected the sensory scores for almost all the sensory attributes. The appearance score for the T_1 was significantly lower than control, whereas the scores for T_2 were comparable to control and T_1 which might be due to lighter colour of *Aloe vera* extract. The flavour and texture scores for both the treatment products were significantly lower (P<0.05) than control. The overall acceptability scores for the treatment chevon rolls incorporated with *Aloe vera* was significantly lower (P<0.05) than control but the scores for the T_2 was comparable to control, which is the reflective of scores of other sensory parameters.

On the basis of different physico-chemical, proximate, colour, texture and sensory properties of chevon rolls incorporated with selected levels of *Aloe vera* and cinnamon bark extract, the developed product is comparable to the control product along with the very good sensory rating.

Table 4
Quality evaluation of chevon rolls incorporated with selected levels of *Aloe vera* and cinnamon bark extract

Parameters	Control	*Aloe vera* extract (T_1-0.4%)	Cinnamon bark extract (T_2-0.25%)
pH	6.54±0.05	6.49±0.07	6.55±0.04
Cooking Yield (%)	90.40±0.69	88.64±1.30	89.69±0.98
Moisture (%)	66.19±0.31	66.45±0.56	65.17±0.52
Protein (%)	17.56±0.09	17.29±0.06	17.48±0.10
Fat (%)	12.46±0.47	11.33±0.37	11.48±0.46
Ash (%)	2.23±0.03	2.50±0.07	2.67±0.05
Instrumental Colour Profile			
Redness (a* value)	9.63±0.10^a	8.35±0.08^a	10.13±0.38^b
Yellowness (b* value)	8.27±0.32	8.86±0.17	7.80±0.24
Lightness	42.49±0.26^a	44.53±0.58^b	43.35±0.38^{ab}
Hue	11.84±0.04^b	11.74±0.06^b	12.78±0.05^a
Chroma	159.32±3.52^b	138.62±1.57^a	163.68±4.00^b
Texture Profile Analysis			
Hardness (N/cm^2)	11.14±0.18	10.94±0.20	11.21±0.11
Springiness (cm/mm)	8.37±0.10^c	5.77±0.42^a	6.86±0.19^b
Cohesiveness	25.46±0.51	25.37±0.30	24.73±0.76
Gumminess (N/cm^2)	5.52±0.070^a	5.29±0.60^{ab}	5.47±0.09^{ab}
Chewiness (N/cm)	125.09±0.25	121.75±2.21	123.84±1.29
Resilience	0.95±0.01	0.85±0.02	0.88±0.02
Stringiness	21.74±0.36^b	21.74±0.34^b	20.22±0.05^a
Sensory Analysis			
Appearance	7.32±0.05^b	7.15±0.06^a	7.25±0.06^{ab}
Flavour	7.45±0.07^b	7.18±0.07^a	7.23±0.07^a
Texture	7.21±0.07^b	7.05±0.07^a	7.02±0.02^a
Juiciness	7.29±0.07^b	7.05±0.05^a	7.11±0.06^b
Overall Acceptability	7.40±0.04^b	7.13±0.07^a	7.33±0.08^a

*Mean±S.E with different superscripts row wise (small alphabet) differ significantly ($P<0.05$). Control- chevon rolls without phyto-extract. n =6 for each treatment.

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